Solution Exo 1

1/ Calcul des variables d'état

$$n = \frac{100}{44} = 2.273\,mol$$

Etat 1:

$$P_1V_1 = P_2V_2$$

$$V_1 = \frac{P_2V_2}{P_1} = \frac{4 \times 0.05}{2} = 0.1\,L$$

$T_1 = T_2 = 1.07$ K

Etat 2:

$$P_2V_2 = nRT_2$$

$$T_2 = \frac{P_2V_2}{nR}$$

باستعمال $R = 0.082\,L \cdot atm/mol \cdot K$:

$$T_2 = \frac{4 \times 0.05}{2.273 \times 0.082} \approx 1.07\,K$$

Etat 3: $P_3 = P_1 = 2$ atm

$V_3 = V_2 = 50$ ml

$$\frac{T_3}{T_1} = \frac{V_3}{V_1}$$

$$T_3 = 1.07 \times \frac{0.05}{0.1} = 0.535\,K$$

2/ Calcul d'énergies

- **Transformation isotherme 1-2**

$$\Delta U = 0, \quad \Delta H = 0$$

$$W_{12} = -nRT \ln \frac{V_2}{V_1}$$

$$W_{12} = -2.273 \times 8.314 \times 1.07 \times \ln(0.05/0.1)$$

$$\ln(0.5) = -0.693$$

$$W_{12} \approx +14.01 J$$

$$Q_{12} = -W_{12} = -14.01 J$$

- **Transformation isochore 2-3**

$$W_{23} = 0$$

$$\Delta U_{23} = nC_v(T_3 - T_2)$$

$$= 2.273 \times 3 \times 8.314 \times (0.535 - 1.07)$$

$$\Delta U_{23} \approx -30.4\, J$$

$$Q_{23} = -30.4\, J$$

$$\Delta H_{23} = nC_p(T_3 - T_2)$$

= 2.273 . 4. 8.314. (0 .535 – 1.07)= -40.44 J

Cp- C_V= R

Cp= R + Cv= 4R

- **Transformation isobare 3-1**

$$W_{31} = -nR(T_1 - T_3)$$

$$= 2.273 \times 8.314 \times (1.07 - 0.535) \approx -10.1\, J$$

$$\Delta U_{31} = nC_v(T_1 - T_3) \approx 30.4\, J$$

$$Q_{31} = \Delta U - W = 30.4 + 10.1 = 40.5\, J$$

$$\Delta H_{31} = nC_p(T_1 - T_3) \approx 40.5\, J$$

$$\Delta U_{cycle} = 0$$

$$\Delta H_{cycle} = 0$$

$$W_{cycle} = -14 + 0 \ - 10.1 = \ \mathbf{3.9} \quad J$$

$$Q_{cycle} = \mathbf{-3.9} \quad J$$

Solution Exo 2

ρ=1g/mL⇒m=10g

n=0.5556 mol l

1- De -30 C° à 0 C°

Q1=nCp(s)ΔT=0.5556×37.8×30

Q1≈630 J

2. Fusion à 0 C°

Q2=n.L_{fus}=0.5556×6010≈3339J

3. de 0 C° à 100 C°

Q3=0.5556×75.2×100

Q3≈4178 J

4. Vaporisation à 100 C°

Q4=n.L_{vap}=0.5556. Lvap

5. de 100 C° à 170 C°

Q5=0.5556×36×70

Q5≈1400J

Qtot= 9547+0.5556Lvap

Lvap= 36815J/mol= 36.8 KJ/mol